

TECHNICAL SPECIFICATION OF ROBOTIZED ASSEMBLY STATIONS

1 Introduction

The purpose of the following technical specifications is to describe:

1. robotic assembly station with one robot for assembling chassis elements by spot welding on a rotary table (TYPE A), 3 pcs
2. robotic assembly station with one robot for assembling chassis elements by arc welding on a rotary table (TYPE B), 2 pcs
3. robotic assembly station with two parallel positioned robots with a rotary table (TYPE C), 1 pcs.

The above devices will be installed at the plant of Patrone&Mongiello Spółka z ograniczoną odpowiedzialnością in Nysa, Poland.

2 General layout of devices

2.1 Robotic assembly station with one robot (type A)

Layout of a robotic assembly station for spot welding should be as follows (fig. 1). The maximum dimensions of the fence and its arrangement, as well as the arrangement of switchboards and the connection points of the different systems remain to be determined and will be discussed between Patrone&Mongiello and the contractor.

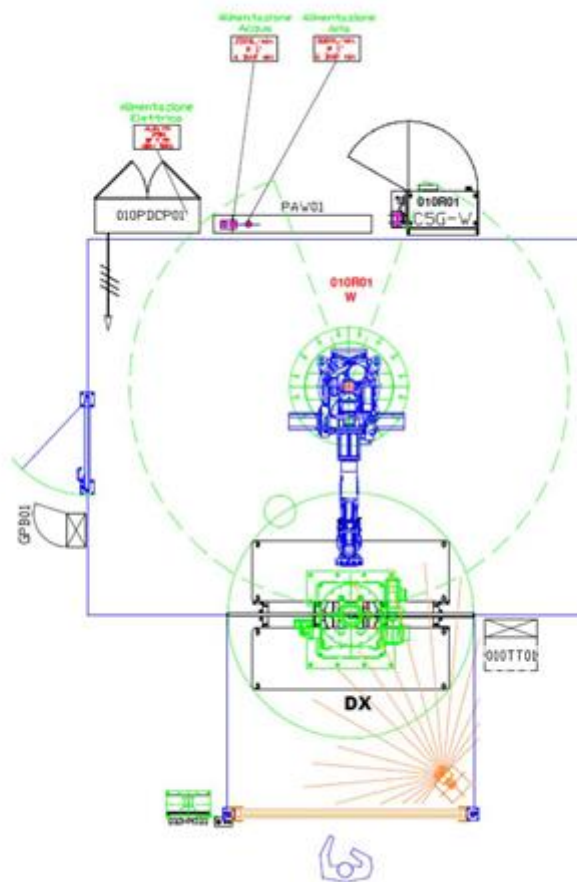


Fig. 1

2.2 Robotic assembly station with one robot (type B)

Layout of the robotic assembly station for arc welding should be as follows (Fig. 2). The maximum dimensions of the fence and its arrangement, as well as the arrangement of switchboards and the connection points of the different systems remain to be determined and will be discussed between Patrone&Mongiello and the contractor.

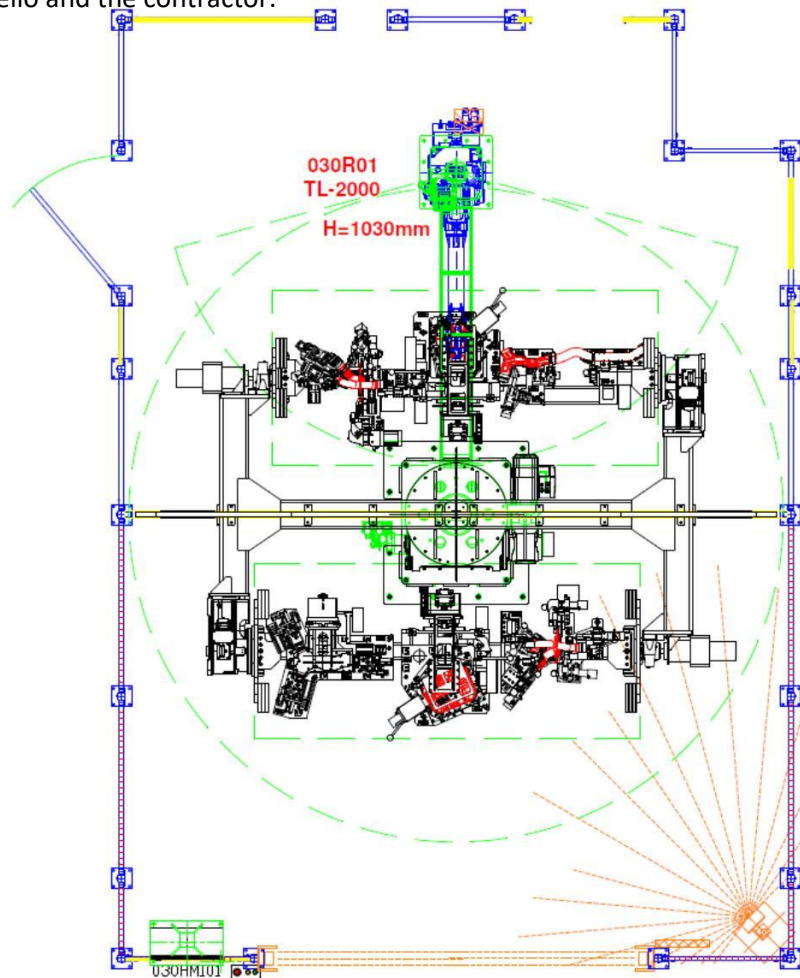


Fig. 2

2.3 Robotized assembly station with two robots (type C)

Layout of a robotic assembly station with two spot welding robots should be as follows (fig. 3). The maximum dimensions of the fence and its placement as well the distribution of switchboards and connections of various systems remain to be determined and will be the subject of discussions between Patrone & Mongiello and the contractor.

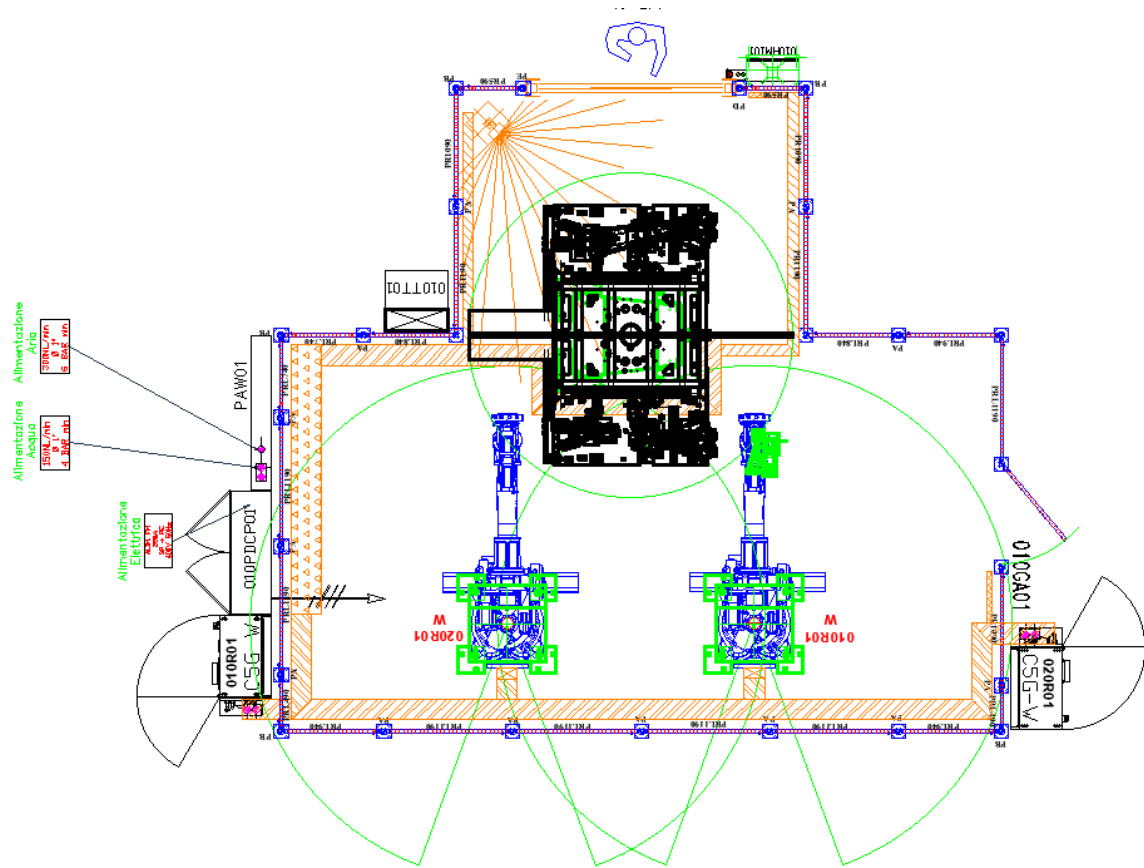


Fig. 3

3) Human-machine PLC interface

Each cell or macro cell should be controlled by 1 PLC Fail Safe controller providing an integrated safety system, located inside the electrical switchboard.

The line described above should be equipped with appropriate human-machine interfaces, such as:

- 1 Control panel with 7" screen
- 2 Button panel for resetting and starting the cycle
- 3 Access button panel for dedicated zones

4) Delivery description

The main components of each technical solution will be described in detail in this paragraph.

4.1) For a single robotic welding cell for spot welding - type A

The main parts of the assembly station

- a) Articulated (anthropomorphic) robot with the following main parameters - 1 pc:
 - Number of axes: 6
 - Pass-through wrist (to reduce overall dimensions) with fully integrated internal equipment for increased performance, efficiency and reliability
 - Maximum lifting capacity of wrist (kg) min. 170
 - Maximum horizontal reach (mm) 2 500
 - Minimum repeatability (mm) 0.10
 - Clamping flange with coupling ISO 9409 - 1 - A 125 ISO 9409 - 1 - A 160
- b) Medium frequency welding box - 1 pc.
- c) Spot welder with an electric clamp integrated with the wrist of a medium frequency welding robot managed as a 7° axis - 1 pc.
- d) Two-position rotary table 0° -180° with servo motor, managed as 8° axis, minimum load capacity (kg) 3 000 (clamping plates must be included in the delivery) - 1 pc.

Other components

- a) Welding table - 1 pc.
- b) Electrode regenerator on the robot - 1 pc.
- c) Electrode cleaning cutters - 1 pc.
- d) Photoelectric safety barriers - 1 pc.
- e) Laser scanner - 1 pc.
- f) A set of mesh perimeter fences - 1 pc.
- g) Doors with electromechanical safety interlocks, complete with a lock and GPB button panels - 1 pc.
- h) HMI operator panel - 1 pc.
- i) Power/management switchboards (WDP, PDP, CP, SCP) and control panels
- j) Full line integration: tubing, cables, pipes, air/water panels etc.

4.2) For a single robotic welding cell for arc welding - type B

The main parts of the assembly station

- b) a) Articulated (anthropomorphic) robot with the following main parameters - 1 pc:
 - Number of axes: 6
 - Maximum lifting capacity of wrist (kg) min. 12
 - Maximum horizontal reach (mm) 1 800
 - Pass-through wrist
 - Minimum repeatability (mm) 0.1
 - Mounting flange with ISO 9409 - 1 - A63 coupling
- b) Wire welder - 1 pc.
 - Torch (pipe) for a wire welder for connection to an articulated robot
 - Max. welding current 400 A
 - Min. welding current 3 A
 - Open circuit voltage 73 V
- a) Rotary table with 2 two-position lathes with a horizontal axis, managed as 7° + 8° + 9° robot axis with a minimum load capacity (kg) 850 (per side), with a minimum plate spacing of 2 000 mm and a vertical rotation positioner - 1 pc .

Other components

- a) Welding table - 1 pc.
- b) Photoelectric safety barriers - 1 pc.
- c) Laser scanner - 1 pc.
- d) A set of mesh perimeter fences - 1 pc.
- e) Doors with electromechanical safety interlocks, complete with lock, window and GPB button panels - 1 pc.
- f) HMI operator panel - 1 pc.
- g) Power/management switchboards (WDP, PDP, CP, SCP) and control panels
- h) Full line integration: tubing, cables, pipes, air/water panels etc.

4.3) For a single welding cell with two robots - type C

The main parts of the assembly station

- a) Articulated (anthropomorphic) robot with the following main parameters - 2 pcs:
 - Number of axes: 6
 - Pass-through wrist (to reduce overall dimensions) with fully integrated internal equipment for increased performance, efficiency and reliability
 - Maximum lifting capacity of wrist (kg) min. 170
 - Maximum horizontal reach (mm) 2 500
 - Minimum repeatability (mm) 0.10
 - Clamping flange with coupling ISO 9409 - 1 - A 125 ISO 9409 - 1 - A 160
- b) Medium frequency welding box - 2 pcs.
- c) Spot welder with electric clamp integrated with the wrist of the robot for medium frequency welding managed as 7 ° axis - 2 pcs.
- d) Two-position rotary table (instead of a crane) 0 ° -180 ° with servo motor, managed as 8 ° axis, minimum load capacity (kg) 3 000 (clamping plates must be included in the delivery) - 1 pc.

Other components

- a) Welding table - 2 pcs.
- b) Electrode regenerators on the robot - 2 pcs.
- c) Electrode cleaning cutters - 2 pcs.
- d) Photoelectric safety barriers - 1 pc.
- e) Laser scanner - 1 pc.
- f) A set of mesh perimeter fences - 1 pc.
- g) Doors with electromechanical safety interlocks, complete with a lock and GPB button panels - 1 pc.
- h) HMI operator panel - 1 pc.
- i) Power/management switchboards (WDP, PDP, CP, SCP) and control panels
- j) Full line integration: tubing, cables, pipes, air/water panels etc.

VERY IMPORTANT NOTE:

the delivery must include 3 pieces of type A cells, 2 pieces of type B cells and 1 piece of type C cell.

5) The expediency of using welding cells and operating parameters

Assumptions

The delivered robotic cells should be equipped with all the necessary elements listed in this technical specification, but without:

- Equipment for fastening and positioning of welded elements
- A special program for operating the welding robot.

After determining the final assignment of the type of parts to be welded in each welding cell, the company will separately order electropneumatic welding devices for fastening and positioning parts during the processing cycle, and then a specific robot program will be created for the machining being performed.

TYPE A WELDING CELLS – 3 PCS.

Type A welding cells will mainly be used for spot welding of medium size chassis components with an average number of points which can vary from 10 to 20 according to customer's technical requirements and related specifications according to drawing. Moreover, it is possible to place several devices in parallel on each individual table position for smaller parts and with a smaller number of points, which in total will always reach the average total number of welding points per table side indicated above.

These welding cells will be used to produce parts that, at maximum production volume, will require an **average spot welding time of 3.5 - 5.0 seconds/point**. These times will lead to an average cycle time of approximately 35-100 seconds per part.

It is assumed that:

- The total number of points may exceptionally vary by less than 10 or by more than 20 per table;
- The cycle time must always be within the above parameters (4-5 s/point), unless parts have special properties and geometry that requires modification.

TYPE B WELDING CELLS – 2 PCS.

Type B welding cells will mainly be used to assemble parts with welds with an average length of 100 to 500mm, depending on customer's technical requirements. In addition, it is possible to place several devices in parallel on one side of the lathe for workpieces with smaller dimensions and shorter welds, which in their entirety always reach the above-mentioned average lengths.

These welding cells will be used to produce parts that, at maximum production volume, will require an **average welding time of 2.0 - 3.0 mm/s**. These times will lead to an average cycle time of approximately 33-250 seconds per part. For components with non-linear and more complex welds, the welding speed can reach a minimum of 2 seconds/mm, which gives a maximum cycle time of approx. 250 seconds per part.

TYPE C WELDING CELL - 1 PCS

The C-type welding cell will mainly be used to assemble medium-sized chassis parts with the number of points, which can be between 20 and 40 on average, depending on customer's technical requirements. Moreover, it is possible to place several devices in parallel on one side of the table for items with smaller dimensions and fewer welding points, which in total will always reach the above mentioned average total number of welding points per table side.

This welding cell will be used to produce parts that, at maximum production volume, will require an **average spot welding time of 2.5 - 3.5 s/point**. These times will lead to an average cycle time of approx. 50-140 seconds per part.

6) Security system

The entire delivery must be made in accordance with the national standards developed for the implementation of the Machinery Directive 2006/42 / EC (Legislative Decree 17/2010).

The machine must be equipped with a safety system required by the applicable health and safety regulations. The entire safety system must fully comply with the latest machinery safety regulations, with the exception of the ventilation systems, for which the purchases is solely responsible.

The principles of using the equipment, safe methods of operating the machine and any hazards for the operator must be described in the operation and maintenance manuals both for the component parts and for the cell itself.

An EC declaration of conformity must be provided for the delivery.

7) The offer includes

- 1 Transport costs
- 2 Start-up, commissioning and operator training
- 3 Movement within the site is the responsibility of the contractor but is carried out using equipment belonging to Patrone&Mongiello
- 4 Warranty